POLLUTION AND SAFETY CONTROLS IN COAL HANDLING AT THE THERMAL POWER STATION

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Electrical Engineering Course, Akashi Technical College (1973)
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Sociology Course, Faculty of Literature(1978)

Employment Record

1978-2002:

Electric Power Development Co., Ltd. (EPDC)

2000-2002: Deputy Secretary General, The Japanese Committee for Pacific Coal Flow (JAPAC) (Seconded)
Group Manager, Coal Flow Promotion Group, International Cooperation Department.

1999-2000: Manager, Business Development Group, International Activities Department. Dealing with marketing activities of the consulting business in the Philippines, Malaysia, Indonesia and Middle East countries

1995-1999: General Manager, Manila Office
Dealing with project coordination of Masinloc Coal Fired Thermal Power Station; project coordination of Leyte-Bohol Interconnection Project; business development of the Engineering Services of Leyte-Mindanao. HVDC Interconnection Project.

1992-1995: Manager, Siting Section, New Isogo Thermal Power Siting Office.
Dealing with the procedure of assessment in order to install the New Isogo Thermal Power Station; with the procedure to obtain the agreement of local government in order to install the New Isogo Thermal Power Station; and with the necessary compensation to the residents in order to install the New Isogo Thermal Power Station

1991-1992:

Denpatsu Coal Tec., Co., Ltd. (EPDC's subsidiary Company)

Manager, General Affairs Section and Employee Relations Section, General Affairs Department. Dealing with the general affairs operation of the company, and with the employment, condition and welfare of the employee.

1988-1991:

Electric Power Development Co., Ltd. (EPDC)

1988-1991: Assistant Manager, General Affairs Section, Kanto Regional Headquarters. Dealing with the General Affairs Section, Kanto Regional Headquarters; with the employment, condition and welfare of the employee in the Regional Area; and with the accounting, contracts and material supply of the Headquarters

1987-1988: Senior Staff, Research and Development Section, Research and Development Department, dealing with R&D administration

1984-1987: Resident Officer in Australia, Fuel Administration Section, Fuel Department. Dealing with the management of Blair Athol Coal Project which EPDC invested 7% of the total necessary finance; and with the research of coal market situation in Australia

1981-1984: Staff, General Affairs Section, Takehara No.3 Thermal Power Plant Construction Office. Accountant and budget of the construction of the project

1978-1981: Staff, Administration Section, Overseas Engineering Services Dept. Dealing with the EPDC's overseas engineering services in Middle East Area.

Pollution and Safety Controls in Coal Handling at Thermal Power Station

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Abstract

Environmental concerns at thermal power stations include scattering coal dust. Some type of coal mixed with minute particles scatters coal dust at the time of the handling such as loading, unloading, conveyance and storage, negatively affecting the surroundings. Anti-dust measures are especially called for at locations situated near populated areas or in national parks. Domed or silo-type sealed coal storage is the most ideal anti-dust solution but costly, so that not every station can afford to introduce it. For open-air storage of coal, it is essential to take anti-scattering measures by putting up windbreak fences, growing trees as a green belt and so forth. For unloading coal, the conventional club-bucket method has been replaced with the continuous unloader system in recent years, and a conveyor system in airtight housing is another example of anti-scattering system.

Secondly, safety control should address generation of heat and ignition. Coal, if in contact with air, goes through a slow process of oxidization and generates heat or catches fire in an extreme case. To control generation of heat, it is important to compact the stockpile, so as to reduce the area in contact with air, or carry out coal "first-in, first-out" strictly. In case a longer period of storage causes higher temperature, it is necessary to re-pile coal. In sealed storage, gases such as CO, methane and etc. produced from coal are likely to cause an explosion of coal dust. To prevent such explosion, strict monitoring and sufficient ventilation are of great importance.

Thermal power stations usually have a 1-2 month buffer stock of coal in anticipation of fluctuations in socio-economic factors in coal exporting economies, marine transportation, weather and so on. Unlike liquid fuels such as oil, coal requires wider storage space, and in addition, there are solid fuel-specific problems in handling coal. I would like to discuss pollution and safety controls in connection with handling below.

1. Pollution control in coal handling

Pollution control sources in coal handling at thermal power stations include, scattering coal dust and rainwater drainage from open-air stockpiling.

(1) Anti-scattering measures

Coal fragility varies depending on mine location as well as mining method. Besides, the distribution of particle size is greatly related to the occurrence of coal dust. In other words, some type (bland) of coal is more likely to cause coal dust.

Coal dust is produced at each stage of thermal power generation, from unloading, conveyance to storage, so that we need to take measures by stage as follows:

(i) Anti-dust measures at the unloading stage

Conventionally, the club-bucket system has been widely used. Coal dust is produced when coal caught with a club-bucket is put down into an unloader hopper. To prevent coal dust, these unloader hoppers are equipped with the water sprinkler device.

Recently, the continuous unloader system has been developed and put into operation to automate the unloading process, improve the unloading capacity and prevent coal falling in the sea. With use of the continuous unloader, the volume of coal dust produced can be markedly reduced.

Photo 1: Unloading with the club-bucket system
Photo 2: Unloading with the continuous unloader system

(ii) Anti-dust measures at the conveyance stage

The connecting portion of a conveyor has the largest concentration of coal dust, so that the belt conveyor system should be completely closed in structure. For the conventional conveyor type, it is necessary to enclose the conveyor in a housing to keep coal from falling and coal dust from scattering. Recently, flow dynamics conveyors have been introduced to prevent dust coal from being produced from the conveyor itself.

Photo 3: Conveyor in a housing

Photo 4: Flow dynamic conveyor

(iii) Anti-dust measures at the storage stage

Coal dust produced at open-air stockpiles is the major cause of coal dust affecting a power station operation. As a drastic solution, the domed or silo-type stockpiling is to be introduced in place of the open-air stockpiling. In terms of cost, however, open-air stock pile, in which stackers and reclaimers are generally used as the main equipment, is less costly and been preferred in most cases.

Photo 5: Domed storage

Photo 6: Silo-type storage

Anti-scattering measures for open-air stockpiling are shown below.

Scattering of coal dust is related to particle size and wind velocity as well as the shape of stock heap of coal. Major anti-scattering measures for open-air stockpiles are as follows:

- To put up windbreak fences around coal stockpiles to slow down the wind speed.
- To sprinkle water over coal heaps, apply a surfactant over the surface of heaps to control scattering coal dust.
- To grow trees and the like around coal stockpiles as a green belt to prevent coal dust flying outside the premise in the direction of neighboring residential area.

Photo 7: Sprinkling water at a stockpile

Photo 8: Dust-proof fence

Photo 9: Green belt

As mentioned above, as a drastic solution to coal dust scattered from coal stockpiles, it is recommended to introduce the domed stockpiling, covering coal stock entirely with a large-scale circular dome, or the silo-type stockpiling. For locations close to densely populated area or on the premise of a national park, in particular, these closed types of stockpiling are to be employed as pollution controls, regardless of higher cost incurred. The following table shows a comparison between the open-air, the silo-type and the domed type stockpiling.

Table 1: Comparison by Stockpiling Type

	Open-air Stockpiling	Silo-type Stockpiling	Domed type stockpiling
1. Major Equipment	Traveling stacker for stacking	The body of a silo	Rotating stacker for stacking
	Reclaimer for loading	Special feeder for reclaiming	Rotating reclaimer to reclaim coal to P/S
2. Main Features of the system	Enough operation performance record	No performance record of a large-size silo put in operation	Higher construction cost
	Larger site area	Minimum site area	Smaller site area
	Not capable of operation in bad weather	Capable operation in bad weather	Capable operation in bad weather
	Sprinkling equipment is required as pollution controls	Perfect pollution controls	Easier to take pollution controls
3. Operational features	Capable of easy mixing coal	Capable of high-precision mixing coal	Capable of mixing coal
	Automation is possible	Easy automation	Automation is possible
	Flexible in switching to a different brand	Switchover of brands is limited by the number of silos	Switchover of brands is limited by the number of units of reclaimer
4. Safety Controls	Anti-scattering dust measure is required	Free of scattering dust	Free of scattering dust
	Regular temperature control is required to prevent natural ignition	Temperature control is necessary for the center of a silo	Regular controls of temperature with a thermometer
	Soundproofing is required, if necessary	Easier soundproofing, because it is located indoor	Easier soundproofing, because it is located indoor
	Free of dust explosion, because it is open air	Anti-dust explosion measure is necessary	Anti-dust explosion measure is necessary
5. Demerit	Insufficient Pollution Controls	Coal Choking issue	High Cost

(2) Rainwater drainage from open-air stock pile

An outflow of sprinkled water and rainwater containing coal dust should not be discharged into the sea to avoid water pollution. To this end, drainage equipment should be installed at open-air stockpiles. A water pit is designed based on the anticipated rainfall and put in place to settle out coal dust. To speed up the settling speed, flocculant can be applied for the process of flocculating sedimentation. Sludge settled out in the water pit is fed back to the stockpile site and conveyed to the boiler to be burnt. The top clear layer of water in the pit can be recycled, e.g. for sprinkling.

Photo 10: Sedimentation pit

2. Safety Controls in Coal Handling

(1) Heating of Coal

Coal, if in contact with air, goes through a process of oxidization and generates heat, which, if accumulated, emits smoke or catches fire in its natural course. Generally speaking, coal at lower carbonization with larger volatile contents tends to generate more heat. Oxidization and a rise in temperature vary depending on the shape of a coal heap, as well. In normal conditions, it is required to control the heat-generating phenomenon at a temperature lower than 60 . To this end, the following measures are taken for the open-air stockpiling and the domed type.

(i) To carry out first-in, first-out according to a operation schedule for each stockpile, not storing coal for longer than 3 months)

(ii) If stockpiling for a long period is necessitated for the purpose of mixing coal or due to the running condition of a power station, to put the pressures to heaped coal with a bulldozer, etc. to reduce the area in contact with oxygen.

(iii) As a means of monitoring a rise in temperature, to carry out an infrared measurement of the surface temperature of heaped coal, and to measure a rise in internal temperature by inserting a thermometer probe into coal stock.

(iv) If a marked rise in temperature is detected, to re-pile the stock. Also, sprinkling water is effective for lowering the temperature, but importantly, a large quantity of water should be sprinkled in a short period of time because a small quantity of water facilitates oxidization the more.

(2) Explosion of Coal

For the silo-type stockpiling and the domed closed stockpiling, it is important to monitor methane and CO produced from coal. When coal dust with a volatility of 12% or more is prevailing at a concentration of 10s g/m3, it is likely to cause an explosion of coal dust given any 800 thermal source nearby, so for the closed stockpiling, it is essential to monitor the concentration of coal dust.

Thank you for your attention !

Pollution and Safety Controls in Coal Handing at Thermal Power Station

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Photo 1:
Unloading with the club-bucket system

Photo 2:

- Unloading with the continuous unloader system

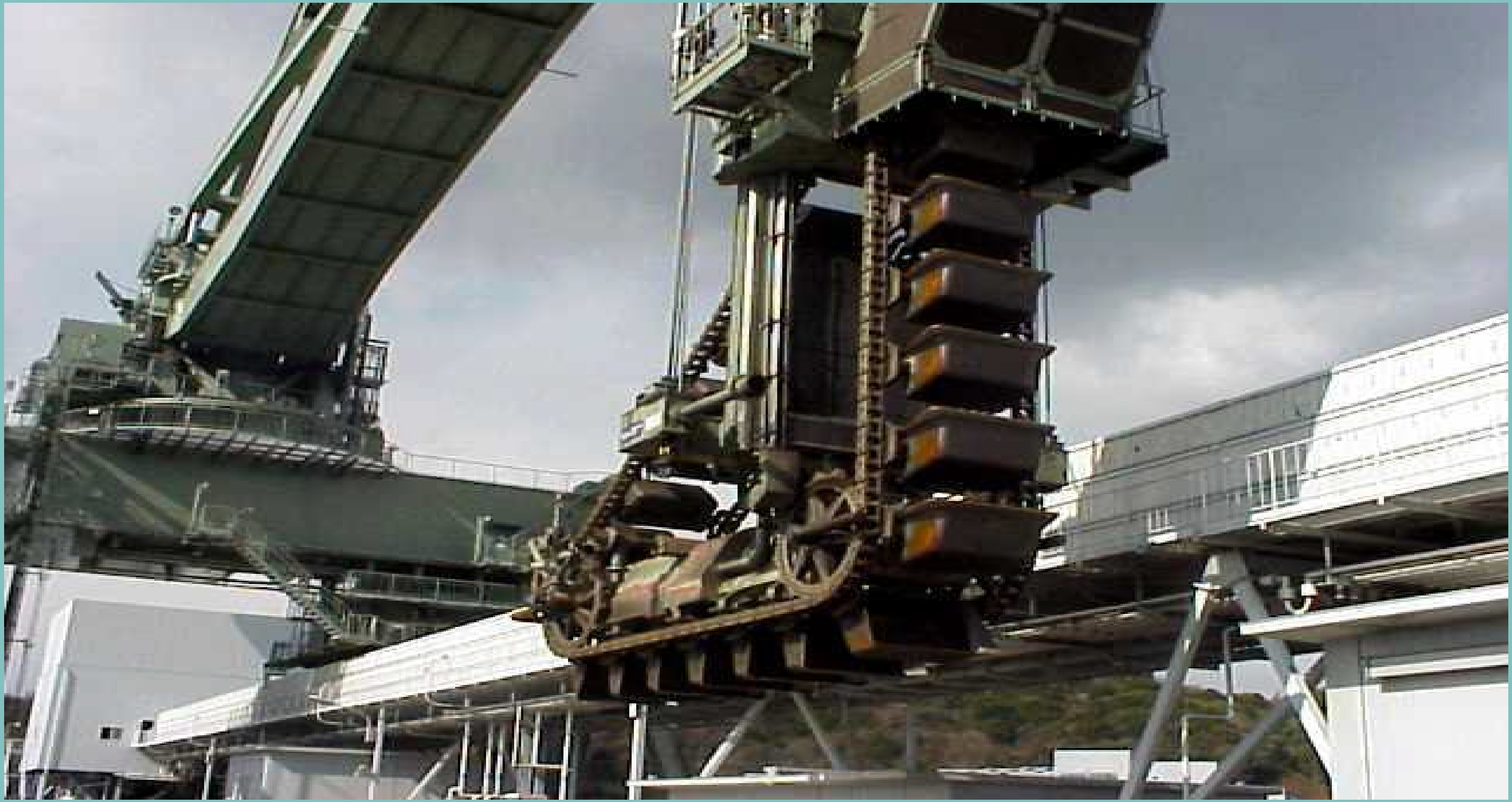

Photo 3: Conveyor in a housing

Photo 4: Flow Dynamic Conveyor

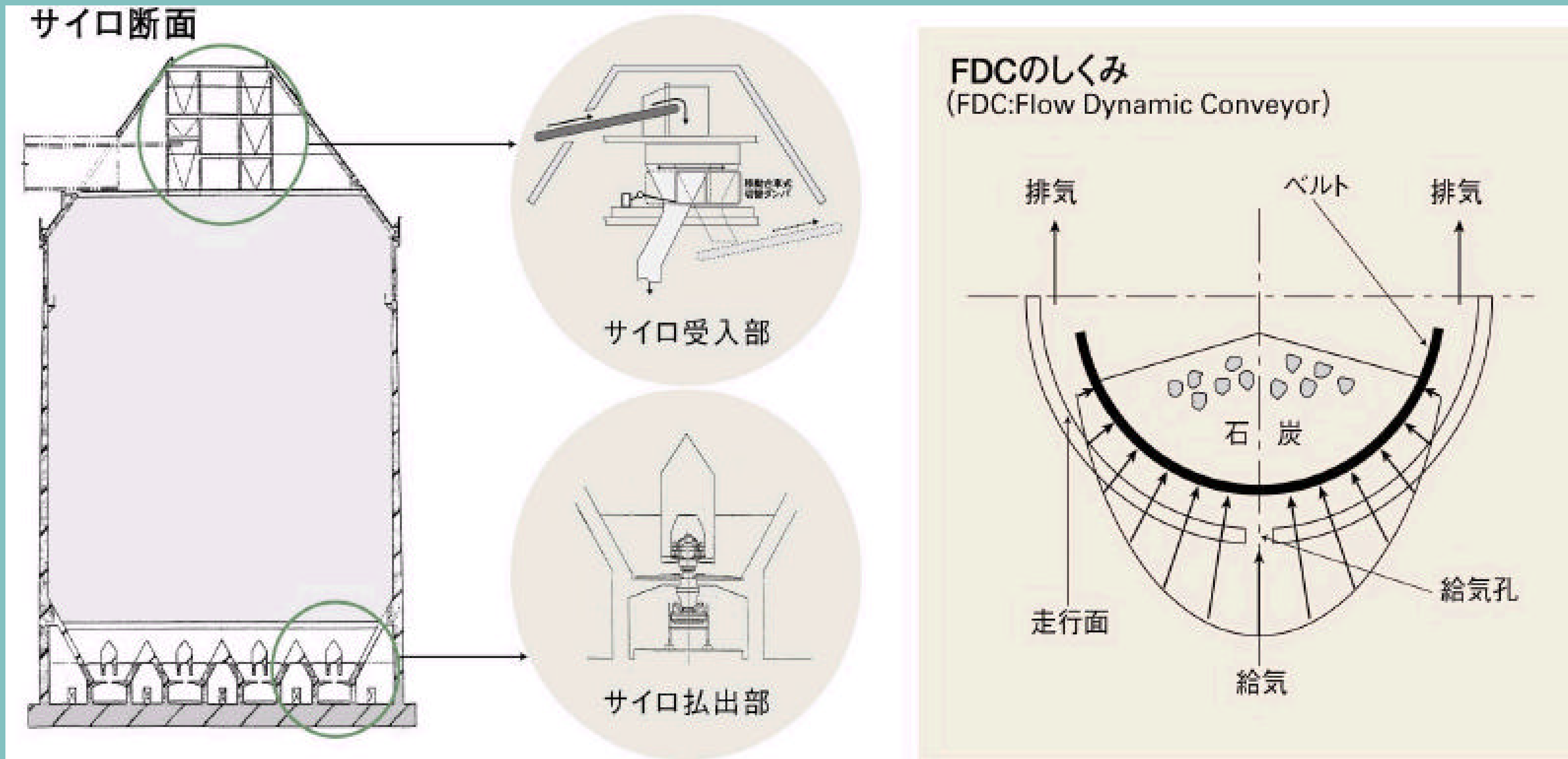

Photo 4’: Flow Dynamic Conveyor

Photo 5: Domed Storage

3 号屋内貯炭場内部

Photo 5’: Domed Storage

3 号屋内貯炭場

Photo 6:Silo-Type Storage

Photo 7: Sprinkling Water at a Storage

Photo 8: Dust-Proof Fence

Photo 9: Green Belt

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